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CHARACTERIZATION STUDY OF WOLLASTONITE SAMPLES FROM CANTON SAINT-ONGE (LAC SAINT-JEAN)

By

Denis Cotnoir, P.Eng.

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Final Report
June 29, 1990



CENTRE DE RECHERCHES MINÉRALES

Québec

Ministère de l'Énergie et des Ressources
CENTRE DE RECHERCHES MINÉRALES
Complexe Scientifique
2700, rue Einstein
Sainte-Foy (Québec)
G1P 3W8

KAPHEARST RESOURCE CORP.
PROJECT 90LI132

CHARACTERIZATION STUDY OF WOLLASTONITE SAMPLES FROM SAINT-ONGE TOWNSHIP (Lac Saint-Jean)

FINAL REPORT
JUNE 29, 1990

COPIE NO: ____

To the attention of :

Mister Barry T. Coughlan
President
Kaphearst Resource Corp.
1250-400, Burrard Street
Vancouver, B.C.
V6C 3A6

Prepared by :

Denis Cotnoir, P.Eng.
Senior Chief Project Engineer

Signature : Denis Cotnoir

INGENIEUR
Denis Cotnoir
31011
QUÉBEC

Approved by :

Jean Gobeil, P.Eng.
Section Head
Metallurgical Research Laboratory

Signature : Jean B. Gobeil

INGENIEUR
Jean B. Gobeil
13981
QUÉBEC

Date : June 29, 1990

CENTRE DE RECHERCHES MINÉRALES, 2700, RUE EINSTEIN, SAINTE-FOY, QUÉBEC G1P 3W8 TÉLÉPHONE (418) 643-4540 TÉLÉCOPIEUR (418) 643-6706

RÉSUMÉ

Laboratory tests done on three samples of wollastonite ore from Saint-Onge Township (Lac St-Jean) indicate that the wollastonite content is between 45 % for lot A to 54 % for lot C. The secondary mineral phase are pyroxene and plagioclase. The physical assays done on lot B show that the brightness is 80,9 and the oil absorption is at 21 ml/100 g. of pigment on the minus 325 mesh fraction. The aspect ratio of the different fractions of lot B vary from 1:5 to 1:10 for 50 % of the needles observed. In the head sample, we note needles with an aspect ratio greater than 1:50 for 5 % of the needles.

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1. INTRODUCTION

This report describes experimental work done on three wollastonite grab samples brought by Mr. E. Bawolak and identified as samples A, B and C. The respective weights of the samples were : 15.4 kilos for lot A, 7.0 kilos for lot B and 3.6 kilos for sample C.

2. CONCLUSIONS

The wollastonite content for lot B is 47 % compared to 45 % and 54 % calculated for lot A and C respectively. The secondary minerals present in lot B are pyroxene, plagioclase feldspar, potassium feldspar and calcite.

The dry brightness of lot B fluctuates from 72.5 for the -200 +325 mesh to 80.9 for the minus 325 mesh which approaches from the dry brightness of the commercial product.

The oil absorption for lot B runs between 18.5 to 21 ml/100 g of pigment depending of the fineness of the particle size.

The aspect ratio measured on different fractions of lot B vary between 1:5 to 1:10 for about 50 % of the needles observed. In the head sample, needles with an aspect ratio greather than 1:50 have been observed.

3. RECOMMENDATIONS

From good results obtained on grab samples, it is recommended :

- to prepare a drilling program to evaluate the tonnage of the deposit;
- to gather from blast hole or trench samples to evaluate the chemical continuity of deposit;
- to run more laboratory tests on the concentration and purification of the wollastonite and to evaluate the chemical and physical properties of purified products.

4. MATERIAL AND EXPERIMENTAL PROCEDURES

4.1 Material

The samples brought by Mr. Bawolak were identified as lot A, B, C and the weight of each one was as follows :

Lot A : 15.4 kilos
Lot B : 7.0 kilos
Lot C : 3.6 Kilos

The grab samples were washed and brushed with water in order to clean the surface and remove all earth and dust. Fine and sand fragments removed from the rock during the cleaning stage were kept apart.

4.2 Experimental procedures

4.2.1 Grinding and screening

Figure 1 illustrates the sample preparation flowsheet. Sample were split to 3 or 4 inches by hydraulic press. The second crushing step was done by a BICO-BRAUN 2 x 3 in. opening jaw crusher. A MASSCO disk pulverizer equipped with alumina diskes was employed to pulverize the sample for the physical properties evaluations.

The samples were screened on 200 and 325 mesh screens to produce three fractions, the +200 mesh, -200 +325 mesh and -325 mesh. These fractions are the most commonly used in the filler industries. These three grades are the major production of R.T. Vanderbilt's Bilmat plant.

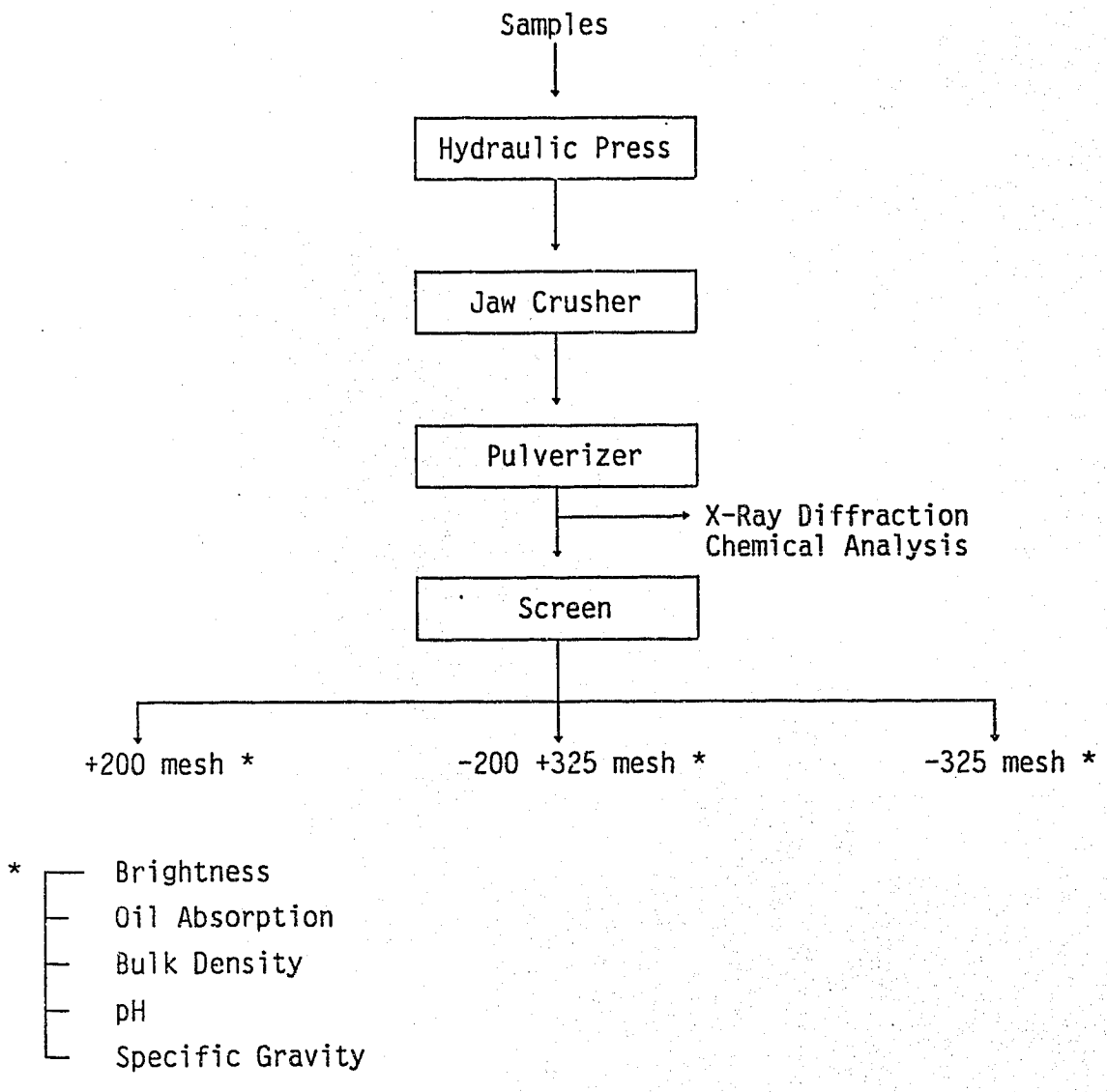


FIGURE 1

Flowsheet for the Preparation of Samples

4.2.2 Characterization Assays

All the physical properties were evaluated in accordance with the ASTM standard tests, except for the particle size determination and the aspect ratio estimation. The brightness test is done with a colorimeter (Pacific Scientific). The particle size determination is done with a Microtrac particle size analyzer. The aspect ratio is estimated via an image analyser equipped Cambridge scanning electronic microscope.

4.2.3 Chemical and X-ray Diffraction Analysis

The chemical analysis is done by X-ray fluorescence for the major oxide elements as SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO on sample pulverrized to 200 mesh. The X-ray diffractions was made on the head sample of lot B.

5. RESULTS

5.1 Chemical and Physical Characteristics of the Wollastonite samples

The chemical analysis of the samples of lot A, B and C are presented in Table I. The X-ray diffraction analysis is resumed in Table II. The Table III summarize the physical properties of sample lot B from Saint-Onge Township. The aspect ratio evaluation is shown in Table IV for the head sample and different size fractions of lot B. The Table V and Figure 2 present the size distribution of the wollastonite of sample B as a fonction of the particle size.

TABLE I

Chemical Analysis of Samples (Lot A, B, C)
from Saint-Onge Township

Element	Lot A (%)	Lot B (%)	Lot C (%)	Theorical Comp.	Synthetic * Comp.
SiO_2	50.4	48.6	51.9	51.7	52.59
Al_2O_3	1.71	2.32	2.22	-	0.31
Fe_2O_3(t)	1.13	1.06	0.88	-	0.09
MgO	6.81	4.86	4.91	-	1.06
CaO	34.8	36.2	35.6	48.3	45.70
Na_2O	0.38	0.58	0.56	-	-
K_2O	0.62	1.10	1.05	-	-
TiO_2	0.14	0.15	0.16	-	-
MnO	0.03	0.03	0.03	-	0.03
P_2O_5	0.06	<0.01	<0.01	-	-
LOI	2.46	4.39	1.51	-	0.19

(*) : produced by Joseph Crosfield & Sons Ltd., U.K.

TABLE II

X-Ray Diffraction Analysis of Sample Lot B

Phases	Minerals	Proportion (%)
Major	Wollastonite	47.0
Secondary	Pyroxene monoclinic,	27.0
	Feldspar K	8.0
	Plagioclase feldspar	11.5
	Calcite	6.5

For Lot A & C, the wollastonite contents have been estimated by calculation at 45 % and 54 % respectively.

TABLE III

Physical Properties of Sample Lot B
from Saint-Onge Township

Physical Properties	Lot B			Standard
	+200 M	-200 +325 M	-325 M	
Brightness ASTM D-1199	73.1	72.5	80.9	84-93
Specific gravity (g/cm³)	2.95	2.95	2.90	2.90
Bulk density				
- Loosed (ASTM B-329)				
g/l	1340	1090	630	n.s.
(lb/ft³)	(83.5)	(68.0)	(39.3)	
- Packed (ASTM B-527)				
g/l	1665	1370	1240	n.s.
(lb/ft³)	(104)	(85.4)	(77.3)	
Average particle size (µm)	-	-	19.5*	3-8 µm
% Finer than 200 mesh	9.1	95.3	100 %	
Oil absorption (ASTM D-281) (ml oil/100 g of pigment)	18.5	22	21	26
pH saturated solution (ASTM D-1208)	9.1	9.5	9.7	8.5-12.0

	Lot A		
	+200 M	-200 +325 M	-325 M
Brightness ASTM D-1199	58.2	58.9	62.8

	Lot C		
	+200 M	-200 +325 M	-325 M
Brightness ASTM D-1199	76.1	74.4	81.4

(*) : done by Leed & Northrup Microtrac

TABLE IV

Aspect Ratio Evaluation for Lot B

Sample	Aspect Ratio *				
	1:1-1:5	1:5-1:10	1:10-1:20	1:20-1:50	>1:50
Head	21 %	42 %	22 %	10 %	5 %
+200 Mesh	27 %	46 %	24 %	3 %	0 %
-200 +325 Mesh	15 %	59 %	25 %	1 %	0 %
-325 Mesh	12 %	64 %	24 %	0 %	0 %

(*) : Aspect ratio : width : length of the needles in sample.

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TABLE V

STRUCTURAL ANALYSIS

Sample: LOT B GRANULO

Size		% weight	% passing cumulative
mm ou μm	mesh		
600.00 μm	28	0.07	99.93
425.00 "	35	1.45	98.48
300.00 "	48	5.35	93.12
212.00 "	65	14.69	78.44
150.00 "	100	18.65	59.79
106.00 "	150	14.82	44.97
75.00 "	200	12.06	32.91
53.00 "	270	10.00	22.91
45.00 "	325	4.35	18.55
31.00 "	-	2.85	15.71
22.00 "	-	2.87	12.84
16.00 "	-	2.66	10.18
11.00 "	-	2.15	8.03
7.80 "	-	1.68	6.35
5.50 "	-	1.35	5.00
3.90 "	-	1.26	3.74
2.80 "	-	1.24	2.50
1.90 "	-	0.98	1.52
1.40 "	-	0.68	0.83
0.90 "	-	0.79	0.04
<0.90 "	- -	0.05	- -
Total		100.00	100.00

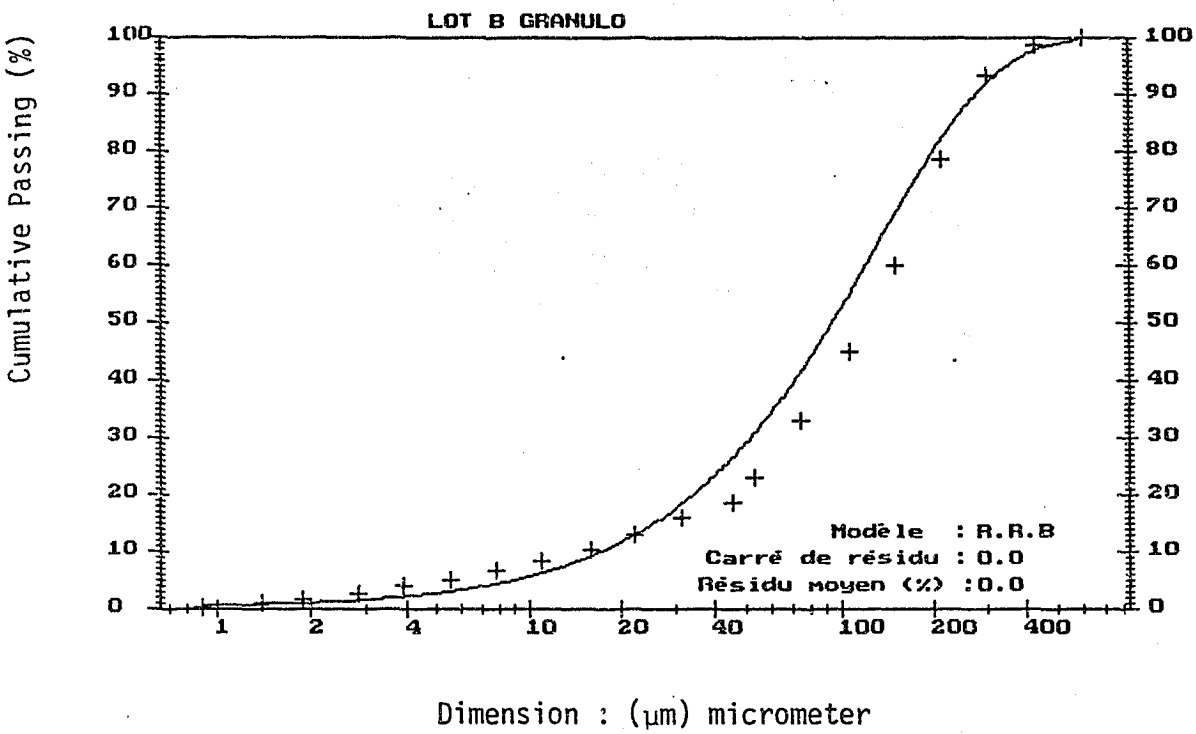


FIGURE 2 : Size Distribution of lot B Sample

6. DISCUSSIONS

The interpretation of the chemical analysis in conjunction with the X-ray diffraction pattern of lot B, indicates that the content of wollastonite for this sample is around 47 %. The secondary minerals present are pyroxene with a proportion of 27 %, followed by plagioclase feldspar, feldspar K (microcline) and 6.5 % calcite.

The chemical analysis of lot C indicate that the wollastonite content is 54 %. In fact, the loss on ignition of lot C is the lowest of the three sample with 1.50 % the assay for aluminium oxide and iron oxide are 2.22 % Al_2O_3 and 0.88 % Fe_2O_3 respectively. The secondary minerals are much the same as in the lot B.

For lot A, Table I shows an intermediate chemical analysis between lot B and C, except for the assay for MgO, which is higher by two percent. The wollastonite content was calculated at 45 % Ca_3 (Si_3O_9).

The physical properties measured on lot B indicate that, the brightness of the minus 325 mesh fraction is 80.9 compared to 84-93 for purified material (standard material in Table I). The brigthness of the material increase with an increases of fineness of the particles.

Lot C show the highest brigthness at 81.4 for the minus 325 fraction.

The oil absorption ratio for the different fractions of lot B is low compare to the standard sample. However, the standard sample has a mean particle size between 3 to 8 microns against 19.5 microns for lot B. Normally, the oil absorption ratio increases with a decrease of particle size. Nevertheless, in paint, oil absorption is low (20-26 ml/100 g) which serves to reduce the quantity of binder required for high pigment loading.

The aspect ratio evaluation, for the different fractions of lot B cited in Table IV, indicate that a ratio of 1:5-1:10 is found in a proportion of around 50 % in all fractions. For the coarse fraction (+200 mesh), we observe an aspect ratio of 1:20-1:50 in a proportion of 3 % of the needles. An example, for the aspect ratio, Nyco, an American wollastonite producer, has an aspect ratio of 1:5-1:10 for his powdered material at 325, 400 mesh. Partek, a Finland producer, sells wollastonite in grade of 70, 200, 325 and 400 mesh with an aspect ratio of 1:3-1:4. Hence, the lot B sample presents a good aspect ratio, if we take into account that the grinding method to prepare the sample (disk pulverization) was not the most appropriate. Nyco uses a special technique (jet milling) to increase the aspect ratio of its material.

Table V presents the structural analysis of lot B after pulverization. For an opening setting of the pulverizer of 20 mesh, we note that a lot of fine material has been generated during this grinding step. In fact, 19 % of the material passes through 325 mesh screen. An observation based on the variation of the pH (Table III) in conjonction with the structural analysis seems to indicate that, the finer materiel could be wollastonite. This is supported by an increase of the pH with a deacrease of the average particle size. To maintain the lenght of the needles of wollastonite, care must be taken during the grinding step by using special techniques.

7. ACKNOWLEDGEMENTS

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